

REMARKS

By this Amendment, Applicants have amended claims 4, 6-7, 13, and 15. Claims 4-7, 13, and 15-18 are pending. In order to clarify the rejections of the claims under 35 U.S.C. § 112, Applicants representative contacted the Examiner on Thursday, December 19, 2002. Applicants acknowledge, with appreciation, the opportunity extended to Applicants' representatives to discuss the rejections under 35 U.S.C. § 112.

Rejections Under 35 U.S.C. § 112, First Paragraph

Claims 4-7, 13, and 15-18 stand rejected under 35 U.S.C. § 112, first paragraph.

More specifically, the Office Action indicates that the claims lack certain features necessary to form a reflection type hologram, but that are known in the art. For example, the Office Action indicates that "a hologram can only be recorded by having an object light and a reference light, *coherent* to each other, and being arranged to *intercept* and *interfere* with each other on a *hologram recording medium*...in order to create a *reflection* type of hologram the reference light and the object light should be incident on the holographic dry plate in an *opposite* direction." Claims 4, 6-7, and 13 have been amended to include such structural features.

The Office Action also indicates that the specification and claims do not enable "using [an] opening extended in the horizontal direction" (i.e., an elongated opening arranged such that the light diffuses in only the *width* direction of the reflection type hologram, as recited in claim 4). During the telephone call on December 19, 2002, the Examiner indicated that she believed that the specification teaches to form the opening in the vertical direction (Figure 16B), and not in the horizontal direction (Figure 16A) (See originally filed specification at page 43, lines 14-27). Applicants respectfully disagree.

→ (The "width" direction recited in the claims and described in the specification is not limited to either of a horizontal or a vertical direction. As explained herein, the claimed width direction is applicable to both the horizontal and vertical directions, as well as angular directions between the horizontal and

vertical directions. This is explained by reference to Attachment A, which includes explanatory Figures A1, A2, B1, B2, C1, and C2. Figures A1, A2, B1, B2, C1, and C2 have not been added to the above-recited application. Rather, they have been attached to the present amendment to make clear that the claimed width direction applies to both the horizontal and vertical directions, as well as angular directions between the horizontal and vertical directions.

In a traditional hologram, reconstructed light is irradiated from a point source and diffuses from the point source in all directions; however, as discussed on page 42 of the originally filed application (and illustrated in Figure 15A), reconstructing an image with light from a point source results in a very small viewing angle (1°) in the vertical direction, which is the height or "length" direction. Further, as shown in Figure 19 of the originally filed application, the length of the visible zone of the hologram is related to the viewing angle in the length direction. Therefore, reconstructing a hologram from a point source produces a very short visible zone which is unsuitable for traffic signals and the like.

To solve this problem, the inventors found that by lengthening the slit in the length direction, so that light is directly incident in the length direction and only diffuses in the width direction, the length of the visible zone can be significantly increased. In contrast, if the slit is widened in the width direction, so that light is directly incident in the width direction and diffuses in the length direction, the image of the hologram is blurred.

The actual orientation (i.e. "vertical" or "horizontal") of the slit is not critical to the effect of increasing the length of the visible zone. The Figures of the originally filed application (e.g., Figure 19) show an embodiment where an overhead light source, the hologram, and the observer are aligned in a vertical plane. In this embodiment, the width direction is therefore horizontal. This configuration is also shown in Figure A1 included in Attachment A.

Those skilled in the art understand that other orientations of the hologram system are also possible. For example, another embodiment is where a light source (e.g., on the side of a road), a hologram, and an observer are aligned in a horizontal plane (as shown in Figure B1 of Attachment A). In this case the

What is meant by "length" is the direction in which the light is directly incident, and the width is the direction in which the light only diffuses.

width direction is vertical. Alternatively, the light source, hologram, and observer may be aligned in any plane at an arbitrary angle, in which case the width direction will be perpendicular to the angle of the plane (as shown in Figure C1 of Attachment A).

In each of these embodiments, the visible zone extends down the length of the road (as shown in Figures A2, B2, and C2 of Attachments A). As such, regardless of whether the "width direction" is actually horizontal, vertical, or in some other direction according to the orientation of the hologram system, the effect of the invention to increase the length of the visible zone can be achieved. Because the width direction recited in the claims applies to each of these orientations, it is respectfully requested that the rejection under 35 U.S.C. § 112, first paragraph (with respect to the feature of the width direction), should be withdrawn

Rejections Under 35 U.S.C. § 112, Second Paragraph

Claims 4-7, 13, and 15-18, stand rejected under 35 U.S.C. § 112, second paragraph.

More specifically, the Office Action indicates that the phrase "'width direction of the reflection-type hologram,' recited in claims 4, 6-7 and 13, is not clear..." As indicated above, the width direction applies to horizontal, vertical, and other orientations, and as such, it is respectfully requested that the rejection under 35 U.S.C. § 112, second paragraph (with respect to the feature of the width direction), should be withdrawn.

Further, the Office Action indicates that the term "'the diffused light' recited in claim 15 is indefinite" as lacking antecedent basis. Claim 15 has been amended accordingly.

Rejection Under 35 U.S.C. § 103(a)

Claims 4-7, 13, and 15-18 stand rejected under 35 U.S.C. § 103(a) "as being unpatentable over" Kulick in view of Honigs et al. (U.S. Patent No. 5,055,684). Applicants respectfully traverse this rejection.

Claims 4 includes the feature of “a reconstructed image of the object is displayed by light from the light source which is incident on the reflection-type hologram through an elongated opening arranged such that the light diffuses in only the width direction of the reflection-type hologram.” Claims 6, 7, and 13 include similar features. The Office Action indicates that Kulick “does not teach such [feature] explicitly.” As such, the Office Action relies on Honigs to teach this feature.

Of initial interest is that while Kulick is directed to a holographic diffraction grating, Honigs is directed to a spectrophometer which comprises a (non-holographic) diffraction grating 20. The diffraction grating of Honigs is merely for dispersing incident light into a spectrum, and is completely unrelated to holography. Therefore, the Kulick and Honigs references are non-analogous, and as such, their combination in the rejection of claims 4-7, 13, and 15-18 is improper.

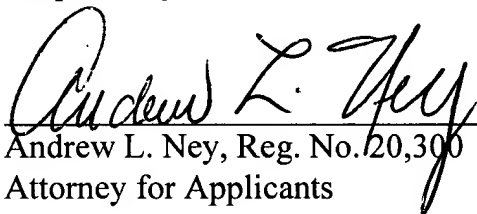
Further, the Office Action indicates that Honigs teaches a system having the benefit of providing more uniformly illuminated light; however, in the device taught in Honigs, the uniformity of illumination comes from using light diffused by a ground quartz plate 21 to illuminate the entrance slit 18. The entrance slit of Honigs does not provide any advantage in the device related to the uniformity of illumination. Therefore, one of ordinary skill in the art would have no motivation to use the entrance slit taught in Honigs to complement the device of Kulick.

Further still, neither Kulick nor Honigs teaches or suggests the claimed feature of lengthening the irradiation opening so that light is directly transmitted in the length direction and diffuses only in the width direction. This feature has a substantial effect in that the visible zone of the holographic image can be significantly increased, which is advantageous for holographic road signs and the like.

Accordingly, Applicants respectfully request withdrawal of the rejection of claims 4-7, 13, and 15-18 under 35 U.S.C. § 103(a).

In view of the amendments and arguments set forth above, the above-identified application is in condition for allowance which action is respectfully requested.

Respectfully Submitted,


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ALN/CMS/ap

Enclosures:

Version with markings to show changes made

Attachment A including Reference Drawings A1, A2, B1, B2, C1, C2

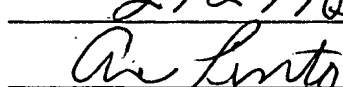
Dated: ~~January 29, 2003~~ 2/27/03

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VERSION WITH MARKINGS TO SHOW CHANGES MADECLAIMS:

1 4. (As Amended) An optical display apparatus, comprising a
2 hologram device and a light source, wherein the hologram device is a reflection-
3 type hologram formed by:

4 light having information of an object incident on a first side of a first
5 hologram dry plate; and

6 reference light incident on a second side of the first hologram dry
7 plate, the second side of the first hologram dry plate being opposite the first side of
8 the first hologram dry plate~~with an incident optical path different from that of the~~
9 ~~light having the information of the object~~, the reference light and the light having
10 the information of the object being arranged to interfere with each other on the first
11 hologram dry plate, wherein

12 a reconstructed image of the object is displayed by light from the
13 light source which is incident on the reflection-type hologram through an
14 elongated opening arranged such that the light diffuses in only the width direction
15 of the reflection-type hologram, and wherein

16 the light having the information of the object is obtained by
17 reconstructing a transmission-type hologram which is formed by: object light
18 incident on a second hologram dry plate, said object light obtained by irradiating
19 the object which is positioned between a slit and the second hologram dry plate;
20 and irradiation light incident on the second hologram dry plate with an incident
21 optical path different from that of the object light.

1 6. (As Amended) An optical display apparatus, comprising a
2 hologram device and a light source, wherein the hologram device is a reflection-
3 type hologram formed by:

4 light having information of an object incident on a first side of a
5 hologram dry plate; and

6 reference light incident on a second side of the hologram dry plate,
7 the second side of the first hologram dry plate being opposite the first side of the
8 first hologram dry plate~~with an incident optical path different from that of the light~~
9 ~~having the information of the object,~~ the reference light and the light having the
10 information of the object being coherent to each other and being arranged to
11 intercept and interfere with each other on the first hologram dry plate, wherein

12 a reconstructed image of the object is displayed by light from the
13 light source which is incident on the reflection-type hologram through an
14 elongated opening arranged such that the light diffuses in only the width direction
15 of the reflection-type hologram, and wherein

16 the light having the information of the object is obtained by
17 reconstructing a transmission-type hologram through a slit adjacent to the
18 transmission-type hologram on which an image of the object is recorded.

1 7. (As Amended) An optical display apparatus, comprising a
2 hologram device and a light source, wherein the hologram device is a reflection-
3 type hologram formed by:

4 light having information of an object incident on a first side of a
5 hologram dry plate; and

6 reference light incident on a second side of the hologram dry plate,
7 the second side of the first hologram dry plate being opposite the first side of the
8 first hologram dry plate~~with an incident optical path different from that of the~~
9 ~~light having the information of the object,~~ the reference light and the light having
10 the information of the object being coherent to each other and being arranged to
11 intercept and interfere with each other on the first hologram dry plate, wherein

12 a reconstructed image of the object is displayed by light from the
13 light source which is incident on the reflection-type hologram through an
14 elongated opening arranged such that the light diffuses in only the width direction
15 of the reflection-type hologram, and wherein

16 the light having the information of the object is obtained by
17 reconstructing a transmission-type hologram through a slit having an aperture
18 adjacent to the transmission-type hologram on which an image of the object is
19 recorded; and a cylindrical lens having its generatrix along a longitudinal direction
20 of the aperture of the slit.

1 13. (As Amended) An optical display apparatus, comprising a
2 hologram device and a light source, wherein the hologram device is a reflection-
3 type hologram formed by:

4 light having information of an object incident on a first side of a
5 hologram dry plate; and

6 reference light incident on a second side of the hologram dry plate,
7 the second side of the first hologram dry plate being opposite the first side of the
8 first hologram dry plate ~~with an incident optical path different from that of the~~
9 ~~light having the information of the object,~~ the reference light and the light having
10 the information of the object being coherent to each other and being arranged to
11 intercept and interfere with each other on the first hologram dry plate, and wherein

12 a reconstructed image of the object is displayed by light from the
13 light source which is incident on the reflection-type hologram through an
14 elongated opening arranged such that the light diffuses in only the width direction
15 of the reflection-type hologram.

1 15. (As Amended) An optical display apparatus according to
2 claim 13, wherein the light having the information of the object is reconstructed
3 light obtained by reconstructing a transmission-type hologram which is formed by:
4 object light obtained by irradiating the object with ~~the~~ diffused light; and
5 irradiation light having an incident optical path different from that of the object
6 light.